CPSC 351 — Tutorial Exercise #14

Many-One Reductions I

These questions are intended to give you practice in establishing ***many-one reductions*** between languages. They are of the difficulty, and length, that would be appropriate for a question on an ***test*** in CPSC 351.

Problems To Be Solved

1. Let $A, B \subseteq \Sigma^\star$ for $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}\}$, and let $x_{\text{Yes}}, x_{\text{No}} \in \Sigma^\star$, such that the following properties are satisfied.

   (i) $B = \{\mu \in \Sigma^\star \mid \mu \in A \text{ and } \mu \text{ ends with "c"}\}$.
   (ii) B is ***unrecognizable***.
   (iii) $x_{\text{Yes}} \in A$ and $x_{\text{No}} \notin A$.

   Give a ***many-one reduction*** to show that A is ***unrecognizable*** as well.

2. Let $L_1, L_2 \subseteq \Sigma^\star$ for an alphabet Σ and let $x_{\text{yes}}, x_{\text{no}} \in \Sigma^\star$ such that the following properties are satisfied.

   (i) The language $L_1 \cup L_2$ is ***undecidable***.
   (ii) The language L_2 is ***decidable***.
   (iii) $x_{\text{yes}} \in L_1$ and $x_{\text{no}} \notin L_1$.

   Give a ***many-one reduction*** to show that L_1 is undecidable as well.